Actuating device for a towing device on a tugboat

The invention relates to the actuating device for a towing device, which toning device can rotate through 360 degrees in the horizontal plane, on a tugboat. The installation comprises a circular, flexible guide body, which is supported by one or more guide supports, around the axis of rotation of the towing device and one or more contact body (bodies). Changing the position of these components leads to the transmission of (contact) forces for actuation of the towing installation. On account of the circular shape of the guide body, the towing installation can be actuated simply and reliably irrespective of the rotational position.

In harbors and shipping areas which are subject to restrictions, ships are often assisted by one or more tugboats. In this case, a cable connection is set up between the ship and the tugboat. The tow cable is in this case connected to the tugboat by means of a tow hook or by means of a tow winch. The towing connection has to be broken easily and reliably in the event of an emergency.

For this purpose, a mechanical actuating system is generally installed, by means of which the towing installation can be released by manual actuation from the bridge and at a number of other locations. A design which is in widespread use involves a long flexible wire (release cable) which is guided through a number of fixed guiding eyelets and is fixed on one side to the towing installation actuation means and on the other side to the ship.

Taking hold of this release cable between two successive guide eyelets and pulling it sideways causes a tensile force to be transmitted to both ends. The tensile force on the side of the towing installation actuation means results in release of the towing installation.

For conventional tugboats, the towing installation is in a fixed position with respect to the bridge, and the cable can be fixed by means of the guiding eyelets along the route from the bridge to the towing installation. This means that the towing installation can easily be actuated at any intervening location.

In this context, it should be noted that the system functions best if the cable is pulled sideways halfway between two guiding eyelets, but as soon as it is attempted to pull the cable at the location of a guiding eyelet, the guiding eyelet prevents lateral movement of the cable, so that the system fails to work.

For new tugboats with a towing installation which can rotate through 360 degrees in the horizontal plane around the deckhouse, it is no longer possible for this cable to be fixed from the bridge to the towing installation, since they move freely with respect to one another. In these designs, the towing installation is mounted on a round outer ring, such that it can rotate freely about a fixed inner ring. For this purpose, it is necessary to develop a new reliable actuating device which enables this actuation to be realized at any desired angle of rotation by simple means.

On account of the need for this actuation, there is a need for a simple system without additional power/auxiliary systems from the point of view of regulations on and inspection of actuating devices.

The object of the present invention is to provide a device which complies with the above requirements, i.e. to realize reliable actuation at any desired angle of rotation using simple means.

This object is realized by a circular, flexible guide body, which is supported by one or more guide supports, around the axis of rotation of the towing device and one or more contact bodies as a result of the position of these components being adjusted with respect to one another, giving rise to contact forces for actuation of the towing installation. On account of the circular shape of the guide body, the towing installation can be actuated easily and reliably irrespective of the rotational position. The circular guide body may comprise all designs which are known from the prior art. The shape may also approximate to the shape of a circle through the use of a number of straight pieces between successive guide supports. The contact body (bodies) may comprise all designs which are known from the prior art, of which there are numerous shapes and dimensions. In this case, the guide body may be secured to the rotatable towing

installation and the towing body (bodies) to the fixed tugboat structure, or vice versa, i.e. with the guide body secured to the fixed tugboat structure and the contact body (bodies) to the rotatable towing installation. The guide body and the contact body (bodies) can move freely with respect to one another and the displacement of these components with respect to one another, in a direction other than the direction of rotation, produces a contact force which actuates the towing installation.

According to a further advantageous embodiment of the invention, the circular guide body is provided with a number of fixed guides. In this case, the contact body moves relative to the flexible guide body, in a direction other than the direction of rotation, with the result that the flexible guide body undergoes a displacement between two separate guides and with the result that a change in length takes place at both ends of the guide body, which can be used to actuate the towing installation.

To prevent the contact body from engaging at the location of a fixed guide support, it is necessary for a plurality of contact bodies to be mounted, with a spacing differing from the spacing between the guide supports, in which case one of the two can carry out the contact function at all times.

Also, it is possible for the play of forces to be transmitted from the contact body to the guide body, which results in a change in length, or for the play of forces to be transmitted from the guide body to the contact body, by changing the tensile force in the guide body.

According to a further advantageous embodiment of the invention, the circular guide body is provided with a number of fixed guides, wherein the contact body has a slight additional freedom of movement in the direction of rotation. If the contact body comes into contact with an opposite guide support, the contact body can move sideways on account of this additional freedom of movement, slide along one of the two sides of the guide support and still engage on the guide body. This slight freedom of movement must be sufficient to avoid the width of a contact support.

In this case, it is possible, for example, to make use of an eccentric hinge, in which case the hinge rotates under a defined resistance force and the contact body rotates along the guide support yet still exerts force on the guide body.

According to a further advantageous embodiment of the invention, the circular guide body is provided with one or more guides, these guides providing support in the radially inward direction but not presenting any obstacle in the radially outward direction.

This can be effected by providing complete circumferential support on the inside by means of a circular groove or by providing a partial support at (equal) intervals by means of separate hooks with the opening facing radially outward. It is also possible for this support to be realized by cables which are tensioned radially outward. An inherent feature of cables is that they absorb tension in the radially inward direction but do not absorb pressure and allow a free movement in the radially outward direction.

In this embodiment, the contact body can move radially outwards together with the guide body without being subject to any resistance from the guide support(s) in the vicinity. The contact force for actuation of the towing installation can therefore be realized at any desired angle of rotation of the towing installation without the guide supports impeding or even preventing the transmission of forces between the contact body and the circular guide body.

According to a further advantageous embodiment of the invention, during the rotation of the towing installation which can rotate through 360 degrees, the contact body successively moves the guide body first of all out of the guide support(s), then onto the contact body and ultimately back into the guide support(s). In this case, the contact body can be positioned at a greater distance from the axis of rotation than the guide support(s), so that the guide body is at a greater distance from the axis of rotation at the location of the contact body and as a result is moved out of the guide support(s).

According to a further advantageous embodiment of the invention, the distance between the guide supports and the contact body is increased in order to compensate

for inaccuracies in the rotation of the towing installation which can rotate through 360 degrees. This rotatable towing installation rotates about a reasonably accurate roller track but even when newly installed has a play of the order of centimeters, on account of the diameter, which is of the order of meters, and after years of use this play can only increase further. Also, the play will increase temporarily under high loads as a result of elastic deformation of the ring structure. To ensure successful operation, it is necessary to prevent the contact body from coming into contact with the guide support(s).

According to a further advantageous embodiment of the invention, the contact body is provided with a roller/wheel/bearing, in order to minimize the resistance and wear with respect to the guide body during rotation of the towing installation.

According to a further advantageous embodiment of the invention, one or both ends of the guide body is/are coupled to the mechanism to either adapt the tensile force or actuate the towing installation. To achieve optimum actuation all the way around with minimal force, it is preferable for both ends to be coupled to the mechanism. To prevent this coupling from impeding the action between the contact body and the guide body, both ends of the guide body will follow the arc of a circle, the two ends will cross one another and will then move out of the range of the contact body and further toward the mechanism. As a result, transmission of forces between the contact body and the guide body is ensured all the way around through the full 360 degrees. Also, numerous variants with a partial overlap of the two ends are possible.

The invention will be explained in more detail below with reference to the exemplary embodiments illustrated in the drawings, in which:

Figure 1 diagrammatically depicts a side view of a conventional tugboat.

Figure 2 diagrammatically depicts a plan view and side view of the new tugboat having a towing installation which can rotate through 360 degrees in the horizontal plane.

Figure 3 diagrammatically depicts the present invention in a three-dimensional view with fixed, closed guide supports.

Figure 4 diagrammatically depicts a plan view of part of the actuating device in the embodiment with an additional rotation hinge on the contact body.

Figure 5 diagrammatically depicts the present invention in the form of a three-dimensional view of the design of fixed guides with an opening on the outer side.

Figure 6 diagrammatically depicts a plan view of part of the actuating device in the embodiment in which the contact body is positioned at a greater distance from the center of rotation than the guides.

Fig. 1 illustrates a conventional twin-screwed tugboat 1 having the following components: tow cable 2, tow hook 3 fixedly connected to deckhouse 4. The figure also shows a release cable 5 passing through a number of fixed eyelets 6, connected on one side to the tow hook 3 and on the other side to the wheelhouse 8. By pulling the release cable sideways halfway between two eyelets, at position 7 (shown as an enlarged detail), it is possible to transmit a tensile force to both ends, so that the tow hook is released.

Fig. 2 shows a tugboat 9 having a towing installation which can rotate through 360 degrees in the horizontal plane and comprises the following components: deckhouse 4, wheelhouse 8, tow cable 2, tow hook 3 connected to a towing installation 10 which can rotate through 360 degrees in the horizontal plane and comprises an inner ring 11, which is fixedly connected to the ship, and an outer ring 12, which can rotate freely by means of a bearing arrangement. The plan view also illustrates a rotated towing installation with the tow hook facing obliquely forward in position 12. For the sake of clarity, the actuating device itself is not shown in this drawing.

Fig. 3 diagrammatically depicts the rotatable towing installation alone; for the sake of clarity, the tugboat and the deckhouse are not shown here. Fig. 3 shows the embodiment in which the guide body rotates with the towing installation, comprising

the following components: an inner ring 11 which is fixedly connected to the ship, an outer ring 12 which can rotate freely by means of a bearing arrangement and has the tow hook 3 and the tow cable 2 connected to it, the circular, flexible guide body/cable 14, the guides 6 connected to the rotatable outer ring and the contact body 15 connected to the fixed inner ring. In this embodiment, the guides have a closed rectangular eyelet, through which the cable 14 runs (shown on an enlarged scale). The contact body 15 can move radially outward in the horizontal plane, along the guide rail 24 which is fixedly connected to the deck, to position 16 (dashed) and grips the cable 14 and also moves it outward. The contact body is also provided on the underside with two parallel guide plates 17, one guide plate engaging over the top of the cable and the other guide plate engaging beneath the cable, in order in this case to make reliable contact with the cable. The ends of the cable 14 cross one another and then extend together to the tow hook 3 by means of two guide rolls 23. This design makes it easy for the tensile force in the cable 14, generated by the contact body being moved outward, to be transmitted to the unlocking arm 25 of the tow hook 3 by means of the rollers 23. As a result of the unlocking arm 25 being rotated, the hook rotates and the cable 2 is released. Consequently, the tow hook can be released in the event of any random rotation on the part of the towing installation.

Fig. 4 illustrates a limited part of the actuating device (in plan view in Fig. 4a and in side view in Fig. 4b) in the embodiment with an additional freedom of movement for the contact body in the direction of rotation, showing the axis of rotation 18, the contact body 15 provided with an eccentric hinge 19 and a moving arm 20 with a vertical guide pin 26 at the end. The contact body can move radially outward along the guide rail 24, which is fixedly connected to the deck, the contact body and the hinge being positioned at a higher level than the guide 6, with only the vertical guide pin 26 positioned at the same height as the cable 14, and can then move along the guides 6. As the contact body 15 moves radially outward (with respect to the axis of rotation 18), the vertical guide pin 26 comes into contact with the fixed guide 6, after which the moving arm 21 rotates about the hinge 19, and the guide pin 26 moves along the guide 6, the cable 14 moves outward and the tow hook is released.

Fig. 5 shows a three-dimensional view once again illustrating the actuating device in the embodiment with guides having openings on the outer side. With this form of guides 27, the cable 14 is supported on the radially inner side but can move radially outward without obstacle. The guide rail 24, the contact body 15, the guide supports 17, the tow hook 3, the tow cable 2 and the actuating mechanism 25 are also illustrated.

Fig. 6 shows a plan view of a limited part of the actuating device in the design with guides with openings on the outer side. The contact body 15 is positioned at a greater distance from the axis of rotation 18 than the guide supports 27. When the contact body rotates into position 22, the cable 14 is successively moved out of the guide, onto the contact body and then back into the guide. In this way, the contact force is transmitted without obstacle from the guides located in the vicinity irrespective of the rotational position.

Although the invention has been described above on the basis of a preferred embodiment, it is possible to make numerous modifications without departing from the scope of the present application. The actuating device can be arranged at all kinds of locations around the rotatable towing installation. It is also possible to use all kinds of different shapes and materials. Furthermore, to improve the reliability of the system, it is possible to consider forming a plurality of both the contact body and the guide body, at least in part.

Furthermore, the system is not restricted to the actuating function for releasing the towing connection, but rather numerous others functions are also possible. Moreover, it is also possible for the function to be fulfilled from the towing installation toward the ship, in which case, by way of example, the load can be transmitted to the tow cable.